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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/779,123	02/07/2001	Anantha R. Sethuraman	5298-02501	9269

35617 7590 05/08/2003

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EXAMINER
LEE, HSIEN MING

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/779,123	Applicant(s) SETHURAMAN ET AL.	
	Examiner Hsien-Ming Lee	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover she t with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,7-12,15 and 17-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,7-12,15 and 17-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Remarks

1. Applicants' request for RCE and cancellation to claims 5, 6, 13, 14, and 16 is acknowledged.

2. Claims 1-4, 7-12, 15 and 17-25 are pending in the application.

Specification

3. The disclosure is objected to because of the following informalities: on page 1, the "CROSS RELATED APPLICATION DATA" needs to be updated, i.e. "application no. 09/143,723, filed August 31,1998" should be -- application no. 09/143,723, filed August 31,1998, **now U.S. Patent 6,232,231** --. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-4, 7-12, 15 and 17-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jaso et al. (US 6,093,631) in view of Koutny (US 6,143,663).

In re claims 1, 2, 9 and 10, Jaso et al. teach a method, comprising:

- etching a plurality of laterally spaced dummy trenches 20 into a dielectric layer 14 between a first trench 15d and a series of second trenches 15a/15b/15c (Fig. 11B);

- filling the dummy trenches 20 and the first 15d and the series of second trenches 15a/15b/15c with a conductive material 16 (i.e. copper or aluminum or tungsten)(Fig. 11C and col.7, lines 3-7); and
- polishing the conductive material 16 to form dummy conductors in the dummy trenches 20 and interconnect in the first trench 15d and the series of second trenches 15a/15b/15c.

Jaso et al. do not expressly teach that the first trench is a relatively wide trench and the series of second trenches are relatively narrow trenches.

However, Jaso *does* suggest the teachings can be applied to the situation of wide-and-narrow trenches. Particularly, in col.3, lines 38-43 Jaso suggest that the teachings can be applied to minimize the difference between the high pattern factor areas (i.e. *equivalent to the "relatively wide trenches"*) and the low pattern factor areas (i.e. *equivalent to the "relatively narrow trenches"*). In other words, Jaso et al. *inherently suggest* that by using the teachings the *dishing effect* between the " relatively narrow trenches" and the " high pattern factor areas' can be minimized.

Therefore, one of the ordinary skill in the art, at the time the invention was made, would have been motivated to apply the same teachings of Jaso et al. to the alternative situation where the first trench is equivalent to the "relatively wide trench" and the series of second trenches are equivalent to the "relatively narrow trenches", since Jaso et al. suggest the *desirability of modifying* the teachings to apply to the situation of wide-and-narrow trenches (col.7, lines 11-18 and col.3, lines 38-43).

Still, Jaso et al. do not teach polishing the conductive material by applying a liquid substantially free of particulate matter between an abrasive polishing surface and the conductive material.

However, Koutny in an analogous art of CMP technique teaches polishing the conductive material (e.g. aluminum formed in trench, col.5, lines 38-47) by applying a *liquid substantially free of particulate matter* (i.e. deionized water or an acidic liquid, see col.4, lines 50-59 and col. 5, lines 48-53) between an abrasive polishing surface and the conductive material for the purpose of shortening the polishing time (col.6, lines 9-16).

Therefore, one of the ordinary skill in the art, at the time the invention was made, would have been motivated to substitute the CMP process of Jaso et al. with the CMP process utilizing the liquid substantially free of particulate matter as taught by Koutny, since by doing so it would shorten the polishing time and avoid abrasive particles left on the polishing surface (col.4, lines 34-38 and col. 6, lines 9-16).

In re claims 3 and 11, Jaso et al. in view of Koutny also inherently teach that polishing said conductive material is performed at a substantially uniform polish rate above said dummy trenches 20 and said series of relatively narrow trenches (i.e. equivalent to trenches 15a-15c) and said relatively wide trench (i.e. equivalent to trench 15d) because of the presence of the dummy interconnects filled in trench 20, which, in turn, would avoid uneven polishing rate with respect to the areas of the "relatively wide trench" and the "relatively narrow trench."

In re claims 4, 12, 18, 21 and 22, Jaso et al. in view of Koutny also teach that said polishing results in dummy dielectric protrusions between adjacent pairs of said dummy trenches 20, said dummy dielectric protrusions having first upper surfaces *substantially coplanar* with second

upper surfaces of said dummy conductors; and the dummy conductors filled in trench 20 are substantially co-planar with the interconnect filled in trenches 15a-15d, as illustrated in Fig 11D of Jaso et al.

In re claims 7 and 15, Jaso et al. in view of Koutny also teach that said abrasive polishing surface comprises particles at least partially fixed into a polymer-based matrix, and wherein said particles comprise a material selected from the group consisting of cerium oxide, cerium dioxide, aluminum oxide, silicon dioxide, titanium oxide, chromium oxide, and zirconium oxide (col.4, lines 50-58, Koutny).

In re claim 8, Jaso et al. in view of Koutny also teach that said polishing comprises placing a CMP slurry onto a polishing pad surface and contacting said polishing pad surface with an upper surface of said conductive material while rotating said polishing pad surface relative to said upper surface (col. 5, lines 57-60 and col.12, claims 5-6, Koutny).

In re claims 17, 19 and 20, the aforementioned teachings of Jaso et al. in view of Koutny also disclose a substantially planar semiconductor topography, comprising:

- a plurality of laterally spaced dummy trenches 20 in a dielectric layer 14, between a relatively wide trench (i.e. equivalent to trench 15d) and a series of relatively narrow trenches (i.e. equivalent to trenches 15a-15c) wherein a lateral dimension of at least one of the dummy trenches 20 is less than a lateral dimension of the wide trench 15d and greater than a lateral dimension of at least one of the series of relatively narrow trenches 15a-15c (Fig.11B);

- dummy conductors (i.e. copper or aluminum or tungsten, col.7, lines 3-5) in said dummy trenches 20 and electrically separate from electrically conductive features below said dummy conductors; and
- conductive lines in said series of relatively narrow trenches 15a-15c and said relatively wide trench 15d, wherein upper surfaces of said conductive lines (i.e. the conductive material filled in trenches 15a-15d) are substantially coplanar with dummy conductor (i.e. the conductor filled in the dummy trench 20) upper surfaces (Fig.11D).

In re claims 23-25, the selection of the lateral dimensions of the dummy trenches, the wide trench and the narrow trenches is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). In particular, Jaso et al. suggest that the teachings can be applied to provide a uniform distribution of interconnect filled in the trenches where the pattern factor (PF) is ranging from 20% (i.e. LPF) to 90 % (i.e.HPF) (col.3, lines 3-56, Jaso et al.). In other words, Jaso's teachings would provide a substantially planar semiconductor topography in which a conductive material is filled in the relatively wide trench and the relatively narrow trenches. In this case, applicants are required to demonstrate the criticality, generally by showing that the claimed dimensions would achieve unexpected results relative to the prior art. See M.P.E.P. 2144.05 III

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

W David Coleman
Primary Examiner
Art Unit 2823

Hsien Ming Lee
May 2, 2003